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## PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents  
United States Patent and Trademark  
Office  
Box PCT  
Washington, D.C.20231  
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year)

09 October 2000 (09.10.00)

International application No.

PCT/FI00/00019

Applicant's or agent's file reference

PPC10968/UH

International filing date (day/month/year)

12 January 2000 (12.01.00)

Priority date (day/month/year)

12 January 1999 (12.01.99)

Applicant

HEINONEN, Mikko et al

1. The designated Office is hereby notified of its election made:



in the demand filed with the International Preliminary Examining Authority on:

14 July 2000 (14.07.00)



in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Charlotte ENGER

Telephone No.: (41-22) 338.83.38

# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference PPC10968/UH	<b>FOR FURTHER ACTION</b>		See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/FI00/00019	International filing date ( <i>day/month/year</i> ) 12.01.2000	Priority date ( <i>day/month/year</i> ) 12.01.1999	
International Patent Classification (IPC) or national classification and IPC <sub>7</sub> B65H 19/22, B65H 18/26			
Applicant VALMET CORPORATION et al			

1.	This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2.	This REPORT consists of a total of <u>3</u> sheets, including this cover sheet.
	<input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).
	These annexes consist of a total of <u>2</u> sheets.
3.	This report contains indications relating to the following items:
I	<input checked="" type="checkbox"/> Basis of the report
II	<input type="checkbox"/> Priority
III	<input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV	<input type="checkbox"/> Lack of unity of invention
V	<input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
VI	<input type="checkbox"/> Certain documents cited
VII	<input type="checkbox"/> Certain defects in the international application
VIII	<input type="checkbox"/> Certain observations on the international application

Date of submission of the demand  14.07.2000	Date of completion of this report  07.05.2001
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer  Ola Engstrand/MP Telephone No. 08-782 25 00

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI00/00019

## I. Basis of the report

1. With regard to the **elements** of the international application:\*

- ☐ the international application as originally filed
- ☒ the description:  
pages 1-7, as originally filed  
pages \_\_\_\_\_, filed with the demand  
pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☒ the claims:  
pages \_\_\_\_\_, as originally filed  
pages \_\_\_\_\_, as amended (together with any statement) under article 19  
pages \_\_\_\_\_, filed with the demand  
pages 9-10, filed with the letter of 12.01.2001
- ☒ the drawings:  
pages 1-2, as originally filed  
pages \_\_\_\_\_, filed with the demand  
pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☐ the sequence listing part of the description:  
pages \_\_\_\_\_, as originally filed  
pages \_\_\_\_\_, filed with the demand  
pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.These elements were available or furnished to this Authority in the following language English which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☒ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheet/fig \_\_\_\_\_

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).\*\*

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

\*\* Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI00/00019

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

## 1. Statement

Novelty (N)	Claims	<u>1-7</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-7</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-7</u>	YES
	Claims		NO

## 2. Citations and explanations (Rule 70.7)

The claimed invention refers to a method for changing a linear load on a reel-up. The invention is intended to solve the problem with wrinkles in the inner layer of the reels. The solution according to the invention is to avoid peaks in the loading pressure between the reel and a reeling cylinder.

In the International Search Report, US 3 202 374 A1 is cited. With respect to claim 1, the document describes a (column 2, line 57 - column 3, line 55; figure 1) method related to the start of the winding of sheet materials on reels on a reel-up. The method comprises an initial reeling device (51 - 53), a reeling shaft (42), a surface drive apparatus (25) and a loading device (46 - 49) for the reeling process taking place after initial reeling.

The subject matter of claim 1 differs from the disclosure of US 3 202 374 A1 in the way the load on the reel is changed from the initial reeling to the reeling process taking place after the initial reeling. When the reeling shaft is transferred from the initial reeling device to the loading device, contact of a part (8) of the loading device, which transmit load to the reeling shaft, takes place when the loading device (11) is substantially in a state devoid of loading force. After that, the loading by means of the loading device is started.

The subject matter of the invention is therefore considered to be novel, to involve an inventive step and to be industrially applicable. Consequently, dependent claim 2 - 7 also fulfils these three criteria.

Other documents cited in the search report are considered less relevant than the aforementioned document.

# RECORD COPY

1/4

## PCT REQUEST

Original (for SUBMISSION) - printed on 11.01.2000 08:34:46 AM

PPC10968/UH

<b>0</b>	<b>For receiving Office use only</b>	
<b>0-1</b>	International Application No.	<b>PCT/FI 0 0 / 0 0 0 1 9</b>
<b>0-2</b>	International Filing Date	<b>1 2 JAN 2000 ( 1 2. 01. 00 )</b>
<b>0-3</b>	Name of receiving Office and "PCT International Application"	<b>The Finnish Patent Office PCT International Application</b>
<b>0-4</b>	<b>Form - PCT/RO/101 PCT Request</b>	
<b>0-4-1</b>	Prepared using	<b>PCT-EASY Version 2.90 (updated 15.12.1999)</b>
<b>0-5</b>	<b>Petition</b> The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
<b>0-6</b>	<b>Receiving Office (specified by the applicant)</b>	<b>National Board of Patents and Registration (Finland) (RO/FI)</b>
<b>0-7</b>	<b>Applicant's or agent's file reference</b>	<b>PPC10968/UH</b>
<b>I</b>	<b>Title of invention</b>	<b>METHOD FOR CHANGING LINEAR LOAD ON A REEL-UP</b>
<b>II</b>	<b>Applicant</b>	
<b>II-1</b>	This person is:	<b>applicant only</b>
<b>II-2</b>	Applicant for	<b>all designated States except US</b>
<b>II-4</b>	Name	<b>VALMET CORPORATION</b>
<b>II-5</b>	Address:	<b>Fabianinkatu 9 A FIN-00130 HELSINKI Finland</b>
<b>II-6</b>	State of nationality	<b>FI</b>
<b>II-7</b>	State of residence	<b>FI</b>
<b>III-1</b>	<b>Applicant and/or inventor</b>	
<b>III-1-1</b>	This person is:	<b>applicant and inventor</b>
<b>III-1-2</b>	Applicant for	<b>US only</b>
<b>III-1-4</b>	Name (LAST, First)	<b>HEINONEN, Mikko</b>
<b>III-1-5</b>	Address:	<b>Salmelantie 80 FIN-04660 NUMMINEN Finland</b>
<b>III-1-6</b>	State of nationality	<b>FI</b>
<b>III-1-7</b>	State of residence	<b>FI</b>

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<b>III-2</b>	<b>Applicant and/or inventor</b>	
III-2-1	This person is:	<b>applicant and inventor</b>
III-2-2	Applicant for	<b>US only</b>
III-2-4	Name (LAST, First)	<b>RÄTY, Jarkko</b>
III-2-5	Address:	<b>Invantie 18 B 23 FIN-04400 JÄRVENPÄÄ Finland</b>
III-2-6	State of nationality	<b>FI</b>
III-2-7	State of residence	<b>FI</b>
<b>IV-1</b>	<b>Agent or common representative; or address for correspondence</b>	
	The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	<b>agent</b>
IV-1-1	Name	<b>TAMPEREEN PATENTTITOIMISTO OY</b>
IV-1-2	Address:	<b>Hermiankatu 6 FIN-33720 TAMPERE Finland</b>
IV-1-3	Telephone No.	<b>+358-3-288 6111</b>
IV-1-4	Facsimile No.	<b>+358-3-288 6262</b>
IV-1-5	e-mail	<b>tampat@patentti.elisa.fi</b>
<b>V</b>	<b>Designation of States</b>	
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	<b>AP: GH GM KE LS MW SD SL SZ TZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT EP: AT BE CH&amp;LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT</b>

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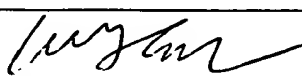
V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	<b>AE AL AM AT (patent and utility model)</b> <b>AU AZ BA BB BG BR BY CA CH&amp;LI CN CR CU</b> <b>CZ (patent and utility model) DE (patent and utility model) DK (patent and utility model) DM EE (patent and utility model) ES FI (patent and utility model)</b> <b>GB GD GE GH GM HR HU ID IL IN IS JP KE</b> <b>KG KP KR KZ LC LK LR LS LT LU LV MA MD</b> <b>MG MK MN MW MX NO NZ PL PT RO RU SD SE</b> <b>SG SI SK SL TJ TM TR TT TZ UA UG US UZ</b> <b>VN YU ZA ZW</b>	
V-5	Precautionary Designation Statement In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.		
V-6	Exclusion(s) from precautionary designations	NONE	
VI-1	Priority claim of earlier national application		
VI-1-1	Filing date	12 January 1999 (12.01.1999)	
VI-1-2	Number	990044	
VI-1-3	Country	FI	
VI-2	Priority document request The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	VI-1	
VII-1	International Searching Authority Chosen	Swedish Patent Office (ISA/SE)	
VIII	Check list	number of sheets	electronic file(s) attached
VIII-1	Request	4	-
VIII-2	Description	7	-
VIII-3	Claims	2	-
VIII-4	Abstract	1	ppc10968.txt
VIII-5	Drawings	2	-
VIII-7	TOTAL	16	



## PCT REQUEST

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	Accompanying items	paper document(s) attached	electronic file(s) attached
VIII-8	Fee calculation sheet	✓	-
VIII-10	Copy of general power of attorney	✓	-
VIII-16	PCT-EASY diskette	-	diskette
VIII-17	Other (specified):	copy of Office Action	-
VIII-18	Figure of the drawings which should accompany the abstract	3	
VIII-19	Language of filing of the international application	Finnish	
IX-1	Signature of applicant or agent		
IX-1-1	Name	TAMPEREEN PATENTTITOIMISTO OY	
IX-1-2	Name of signatory	Unto Hakola	

## FOR RECEIVING OFFICE USE ONLY

10-1	Date of actual receipt of the purported international application	12 JAN 2000	( 12 -01- 2000 )
10-2	Drawings:		
10-2-1	Received		
10-2-2	Not received		
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application		
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)		
10-5	International Searching Authority	ISA/SE	
10-6	Transmittal of search copy delayed until search fee is paid		

## FOR INTERNATIONAL BUREAU USE ONLY

11-1	Date of receipt of the record copy by the International Bureau	08 FEBRUARY 2000	( 08. 02.00 )
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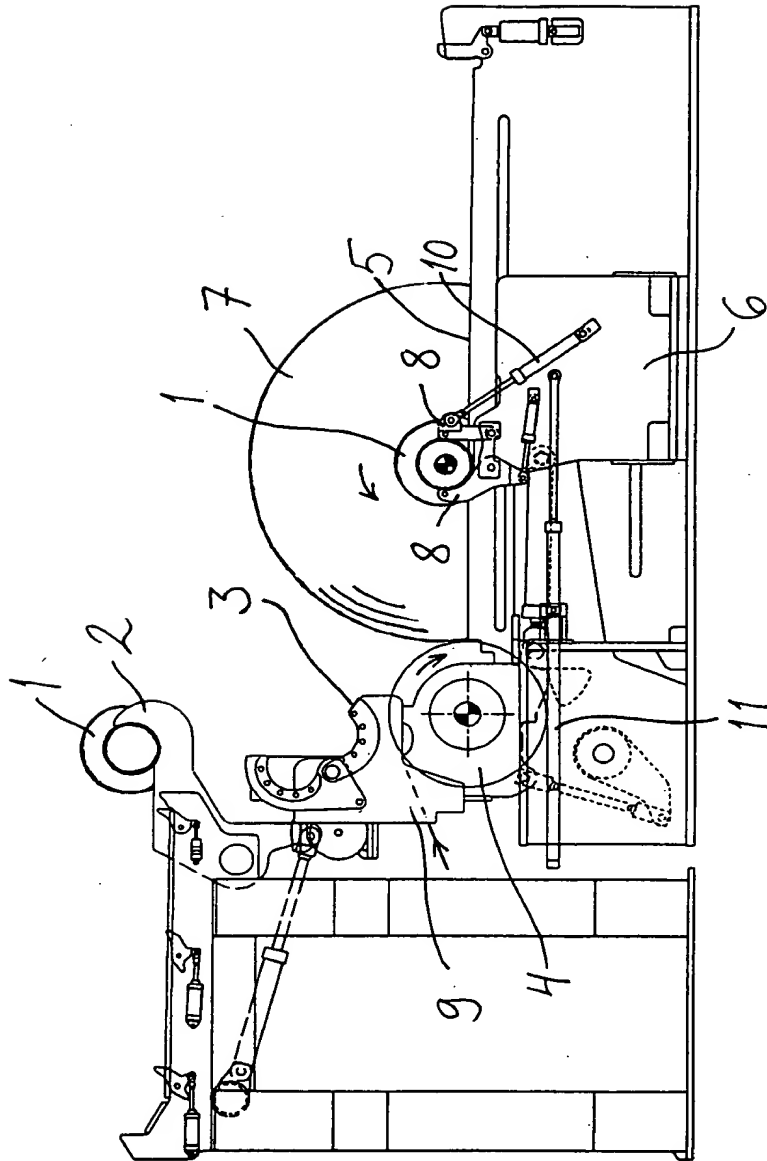
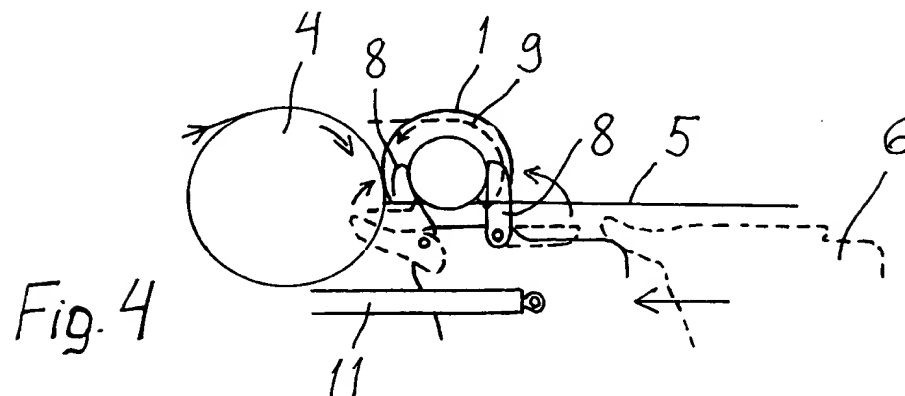
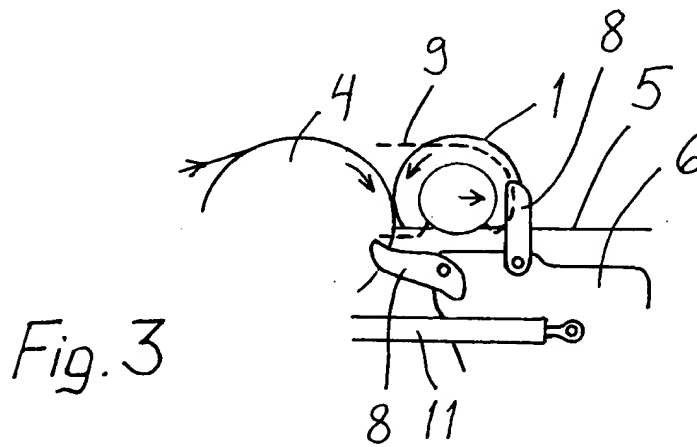
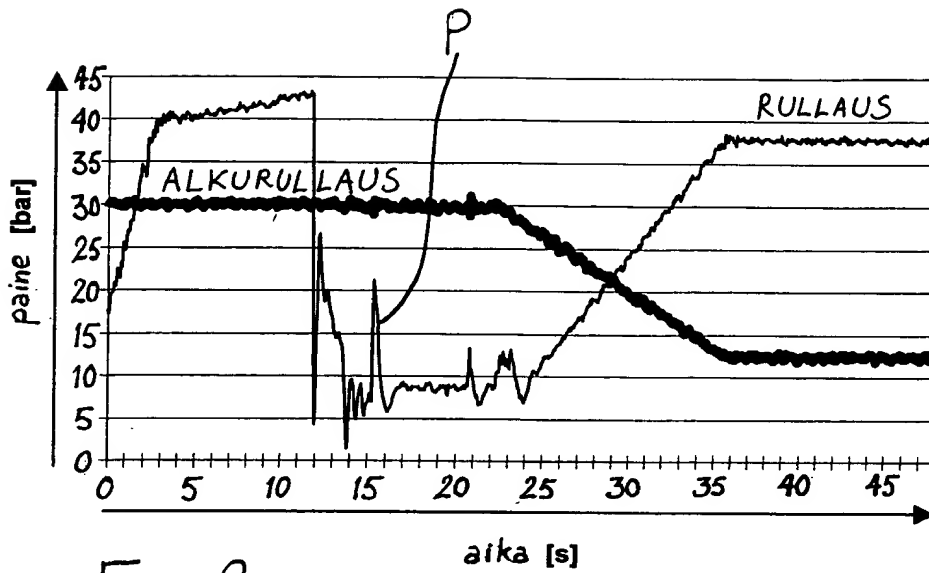


Fig. 1



## Menetelmä viivakuorman vaihtamiseksi rullaimella

Tämän keksinnön kohteena on menetelmä viivakuorman vaihtamiseksi paperirainan rullaimella. Rullain käsittää pääasiassa alkurullauslaitteen, rullausakselin, rullaussylinterin ja kuormituslaitteen. Viivakuormalla tarkoitetaan sitä rullauksessa tarvittavaa voimaa, joka kuormittaa rullausakselille muodostuvaa paperirullaa. Mainittu rullauksessa tarvittava voima tuodaan rullausakselille tehtävälle rullalle pääasiallisesti rullaussylinterin välityksellä siten, että tarvittava voima, viivakuorma syntyy mainitun rullaussylinterin ulkokehän ja muodostuvan rullan ulkokehän välisen nipin välityksellä, kun alkurullauslaitteessa ja kuormituslaitteessa rullausakselin päätyihin vaikuttavilla voimalaitteilla ainakin pääasiallisesti aikaansaadaan mainitun nipin kuormitus. Alkurullauslaitteessa tapahtuu rullan pohjaosan muodostaminen rullausakselille, jonka jälkeen rullausakseli siirretään kuormituslaitteeseen rullattavaksi täydeksi paperirullaksi.

Nippiä kuormittavaa voimaa voidaan säätää alkurullauslaitteen ja kuormituslaitteen aseman perusteella johdetuilla ohjaussignaaleilla siten, että nipin kuormitus on riippuvainen ennaltamäärätyllä tavalla mahdollisesta alkurullauskulmasta, kasvavan rullan säteestä, tai ajasta, eli viivakuorma muuttuu jonkin mitattavan tekijän funktiona. Siinä siirtovaiheessa, jossa rullausakseli ja sille muodostettavana oleva rulla siirretään mainitun alkurullauslaitteen tai vastaavan kannatuksesta ja kuormituksesta kuormituslaitteen kuormitukseen, syntyy viivakuormaan usein voimapiikki, joka häiritsee rullaustapahtumaa.

Kyseessä olevaa rullainta käytetään yleisesti mm. paperikoneesta tai paperin jälkikäsitteilylaitteesta tulevan paperirainan kiinnirullaukseen. Kyseessä on jatkuvatoiminen rullain, jossa rullataan peräkkäin konerullia. Täyden rullan tultua täyteen vaihdetaan raina kulkemaan uudelle rullausakselille. Raina rullataan rullausakselin ympärille ja rullaimessa vähitellen täyteen mittaan kasvavaa rullaa painetaan kuormituslaitteella rullaussylinteriä vasten, jonka yli raina tietyssä sektorissa kulkee ja jota pyöritetään haluttua rainan nopeutta vastaavalla kehänopeudella. Ennen rullan valmistumista uusi rullausakseli voidaan tuoda alkurullauslaitteella ajonopeuteen kiihdytettynä nippikosketukseen rullaussylinterin

5 kanssa niin, että sekin saa vastaavan kehänopeuden. Heti kun paperi-  
rulla on saavuttanut halutun läpimitan, se siirretään eroon rullaussylin-  
teristä. Tällöin sen pyörimisnopeus alkaa hidastua, mikä aiheuttaa sen,  
että uuden rulla-akselin ja valmiin rullan väliin muodostuu rainalenkki.  
5 Tämä lenkki ohjataan esim. paineilmasuihkulla kiertymään uuden rulla-  
akselin ympärille, jolloin se repeää irti valmiista rullasta. Tunnetaan  
myös muita vaihtotapoja.

10 Kuormituksen vaihtelujen johdosta em. siirtovaiheessa esiintyy varsin-  
kin suurilla nopeuksilla rullattaessa ongelmana se, että rullien sisäker-  
rokseen muodostuu rynkkyjä niin, että rullien pohjaosa menee hylkypa-  
periksi. Hylkyyn menevän paperin osuus saattaa olla jopa 2–3 %, mikä  
aiheuttaa paperitehtaalle huomattavia taloudellisia menetyksiä.

15 Tunnettu menetelmä viivakuorman vaihtamiseksi rullaimella esitetään  
esimerkiksi patentissa FI-71107, jota vastaa US-patentti 4634068.  
Tässä toisiohaarukat ajetaan päin ensiöhaarukoissa alkurullattavaa  
rullausakselia siten, että haarukat törmäävät rullausakseliin. Viivakuor-  
maa hallitaan tässä siirtovaiheessa laskemalla tasaisesti ensiöhaaru-  
20 koiden aiheuttamaa kuormitusta ja nostamalla samalla tasaisesti toisio-  
haarukoiden kuormitusta, jolloin summaviivakuorma pysyy oleellisesti  
samana. Törmäyksestä rullausakseliin aiheutuu kuitenkin aina selvä  
viivakuormapiikki. Näinollen häiriön aikaansaa kuormituksen vaihdon  
lisäksi myös kuormituslaitteen siirto asemaan, jossa se voi vastaan-  
25 ottaa rullan alkurullauslaitteelta, ja tämä viimeksimainittu tekijä pääsee  
vaikuttamaan kuormituksen siirrossa, vaikka viivakuormaa pystyttäi-  
siinkin hallitsemaan hyvin siirtovaiheessa kuormituksen aikaansaavia  
toimilaitteita ohjaamalla.

30 Esimerkiksi yleisesti käytössä olevassa rullaintyyppissä on koneen pi-  
tuussuunnassa (konesuunnassa) liikuteltavat rullausvaunut, jotka toimi-  
vat kuormituslaitteena muodostettaessa rulla loppuun alkurullauksen  
jälkeen. Vaunuissa on ohjainleuat, jotka painavat rullausakselia pää-  
dyistä kohti rullaussylinteriä. Ohjainleuat painavat rullausakselia voimal-  
35 la, joka määräytyy rullausvaunujen liikutteluun käytettyjen toimilaitteiden  
voiman mukaan. Kun toimilaitteilla ajetaan vaunu kiinni rullausakseliin,

on niissä aina liikkeen varmistamiseksi tietty paine, joka aiheuttaa "kuormitusiskun" ohjainleukojen koskettaessa rullausakseliin.

5 Keksinnön mukaisella menetelmällä voidaan välttää rullausakseliin kohdistuva ylimääräinen kuormitus siinä vaiheessa, kun rullausakseli siirretään alkurullauslaitteesta sen kuormituslaitteen kuormitukseen, jonka avulla suurin osa rullasta muodostetaan. Keksinnön mukaiselle menetelmälle on pääasiassa tunnusomaista se, mitä on esitetty oheisen patenttivaatimuksen 1 tunnusmerkkiosassa.

10 Keksinnön mukaisella menetelmällä rullausakselin vaihdossa ilmenevä kuormituksen vaihtelu saadaan olennaisesti entisestäänkin minimoitua ja siten paperirullista tulee tasalaatuisia mm. jatkojalostusprosesseja silmälläpitäen. Keksintö perustuu ohjainleukojen asentojen tai aseman  
15 säätöön ja kuormituslaitteen voiman säätöön ennen siirtovaihetta siten, että kuormituspiikkiä ei synny.

Seuraavassa keksinnön mukaista menetelmää selostetaan esimerkin avulla viittaamalla seuraaviin piirustuksiin, joissa

20 kuva 1 esittää esimerkinomaisesti erästä rullaintyyppiä sivukuvantona,

kuva 2 esittää tekniikan tason mukaisia kuormituspaineita siirtovaiheessa,  
25

kuva 3 esittää kaavamaisesti menetelmän ensimmäistä suoritusmuotoa, ja

30 kuva 4 esittää kaavamaisesti menetelmän toista suoritusmuotoa.

Tässä tapauksessa keksinnön mukaista menetelmää toteutetaan kuvan 1 mukaisella rullaimella, jossa edellä mainitun patentin FI-71107 ensiöhaarukoita vastaavat alkurullauslaitteen 9 lukitusleuat 3 ja toisiohaarukoita vastaavat rullausvaunuihin 6 kääntyviksi pystytasossa nivelöidyt toisioleuat 8, joista rullaussylinterin 4 puoleinen on lukitusleuka ja rullausakselin päädyn toisella puolella oleva on ohjainleuka. Rullausvau-

- nut 6 liikkuvat pitkin johdekiskoja lineaarilaakereiden ja rullan kuormituksen aikaansaavien hydraulisylinterien 11 avulla, joista jäljempänä käytetään nimitystä kuormitustoimilaite. Kuormituslaite, jolla rullaa kuormitetaan rullaussylinteriä 4 vasten, muodostuu hydraulisylintereistä
- 5 11 ja mekanismista, jolla hydraulisylinterit 11 ovat voimaa välittävässä yhteydessä rullausakselin 1 päätyihin, tarkemmin sanoen rullausakselin laakeripesiin. Mekanismi, jolla hydraulisylinterien voima välitetään rullausakselin päätyihin, muodostuu tässä tapauksessa rullausvaunuista 6 ja ohjainleuoista 8. Rullan halkaisijan mittausta varten rullausvaunut 6
- 10 on varustettu asemanmittauslaitteilla, jotka on sijoitettu koneen kummallekin puolelle. Rullaa kannatetaan rullaimessa tunnetulla tavalla rullausakselin 1 päädyistä, jotka ovat rullauskiskojen 5 tai vastaavien tukielementtien kannatuksella.
- 15 Kuvan 1 mukaisesti rullausakselin vaihdon alkutilanteessa alkurullauslaite 9 on yläasennossa ja alkurullauslaitteen lukitusleuat 3 ovat auki. Alkurullauskäytön kytkin on myös auki. Rullausakselivarastossa on tyhjä rullausakseli 1 alaslaskuvarsien 2 poimittavaksi.
- 20 Rullausakseli 1 tuodaan alas alaslaskuvarsilla 2 alkurullauslaitteeseen 9. Alkurullauslaitteen leuat 3 lukittuvat automaattisesti heti, kun rullausakseli 1 on alhaalla alkurullauslaitteen 9 leuoissa 3. Alkurullauskäytön kytkin suljetaan ja se siirtyy ryöminnälle. Tyhjä rullausakseli 1 kiihdytetään ratanopeuteen ja alkurullauslaitetta 9 käännetään tietty matka,
- 25 esim. tiettyyn kulma-asentoon rullaussylinterin 4 suhteen tai niin, että rullausakseli 1 laskeutuu kiskoille. Nippi rullaussylinterin 4 ja rullausakselin 1 välillä sulkeutuu automaattisesti kääntöliikkeen aikana. Rullausvaunut 6 siirretään vaihtopositioon, kun paperirulla on saavuttanut halutun läpimitan. Rulla siirretään näin irti rullaussylinteristä 4. Raina vaihdetaan uuden rullausakselin 1 päälle jollain sopivalla tavalla.
- 30
- 35 Täyden rullan 7 pysäyttäminen tapahtuu jarruttamalla. Kun rulla 7 on pysähtynyt, jarrutus lakkaa. Rullausvaunujen 6 ohjainleuat 8 ja lukitusleuat 8 kääntyvät automaattisesti alas, jolloin täysinäinen rullausakseli 1 vierii kiskoja 5 pitkin pysäyttimelle, josta se voidaan siirtää nosturilla pois koneelta.

Sinä aikana, kun täyttä rullaa 7 siirretään pois koneelta, raina rullautuu alkurullauslaitteessa 9 olevan rullausakselin 1 päälle, ja rullaa kuormite-  
taan rullaussylinteriä 4 vasten alkurullauslaitteen 9 toimilaitteilla, jotka  
vaikuttavat lukitusleukojen 3 kautta rullausakselin 1 päätyihin. Seuraa-  
5 vassa vaiheessa alkurullauslaite 9 käännetään alas kiskoille 5, jos  
vaihto on suoritettu rullausakselin ylemmässä kulma-asemassa, ja rul-  
lausvaunut 6 ohjataan kohti alkurullauslaitteessa 9 kiskojen 5 päällä  
olevaa rullausakselia 1.

10 Kuvassa 2 on esitetty alkurullauslaitteen 9 kuormituksesta vastaavien  
toimilaitteiden painetasot ja rullausvaunujen kuormituksesta vastaavien  
kuormitustoimilaitteiden 11 painetasot eräässä siirtovaiheessa. Ohjain-  
leuat 8 on käännetty rullausvaunuissa 6 olevilla toimilaitteilla 10 ylös,  
jolloin ohjainleuka törmätessään rullaussylinteriin aiheuttaa kirjaimella P  
15 merkityn painepiikin ja vastaavan kuormituspiikin rullaimessa.

Keksinnössä kuormituslaitteen kosketus rullausakseliin tapahtuu  
kuormitusvoimattomasti, t.s. kuormitustoimilaitteissa 11 ei ole viiva-  
kuorman aikaansaavaa voimaa.

20 Keksinnön ensimmäisen vaihtoehdon mukaan (kuva 3) vaunuja 6 ohja-  
taan rullausakselia 1 kohti hyvin pienellä nopeudella ohjainleuat 8 yl-  
hällä ja vaunut 6 pysäytetään noin 10 mm ennen kuin ohjainleuat 8  
saavat kosketuksen alkurullauslaitteessa 9 olevaan rullausakseliin 1.

25 Tässä vaiheessa, kun ohjainleuat 8 eivät vielä kosketa rullausakselia 2,  
kytketään paine pois kuormitustoimilaitteista 11 ja niiden kammiot ovat  
venttilien kautta avoimina tankkilinjoihin. Odotetaan niin kauan, että  
rainarullan R halkaisija kasvaa siten, että rullausakselin 1 pääty siirtyy  
kiinni ohjainleukaan 8 ja alkaa liikuttaa rullausvaunuja 6 mukanaan.

30 Tämä voidaan havaita rullausvaunujen 6 asematiedosta, esim. aseman  
ilmoittavalla anturilla. Tällöin rullausvaunujen 6 lukitusleuat 8 voidaan  
nostaa ylös rullausakselin 1 päätyjen vastakkaiselta puolelta, jolloin ne  
sulkeutuessaan lukitsevat rullausakselin 1 rullausvaunuihin 6. Samalla  
voidaan kytkeä paine kuormitustoimilaitteisiin. Viivakuorman vaihto

35 tapahtuu esim. julkaisun FI-71107 ja kuvan 2 periaatteen mukaan siten,  
että alkurullauslaitteen 9 aiheuttamaa kuormitusta vähennetään tietyltä  
aloitustasolta nollatasolle samanaikaisesti kun rullausvaunujen



- kuormitusta lisätään, kunnes kuormitus on saman suuruinen kuin alkurullauslaitteen 9 kuormitus ennen vaihdon aloittamista, ts. kokonaiskuormitus säilyy vakiona. Periaate on siis sama kuin kuvassa 2, mutta kuormituslaitteen kuormituksen ja sen seurauksena viivakuorman nosto alkaa nolasta. Mitään viivakuormapiikkiä ei muodostu, koska ohjainleukoja 8 ei ajeta rullausakselia päin, vaan rainarulla saa vapaasti kasvaa kiinni rullausvaunuihin 6.
- Toisen vaihtoehdon mukaan (kuva 4) rullausvaunut 6 ajetaan kuormituksensiirtoasemaan sekä ohjainleuat että lukitusleuat ala-asennossa. Ohjausvaunut siirretään paikkasäädöllä oikeaan kohtaan siten, että leuat sulkeutuvat tampuuritelan 1 päätyjen molemmille puolille. Kun leuat 8 sulkeutuvat, kuormitustoimilaitteiden 11 voimaksi asetetaan 0 N, jolloin kosketus rullausakseliin 1 tapahtuu ilman kuormitusvoimaa, ja kuormituspiikkiä ei esiinny. Käytännössä rullausvaunut 6 asetetaan voimasäädölle ja voimaohjeeksi annetaan 0 N. Kuormitus nostetaan tämän jälkeen samoin kuin edellä.
- Molemmissa vaihtoehdoissa kuormitusvoimat voidaan rampitata puhtaasti nolasta viivakuormavoimaan kuormituslaitteella ja viivakuorma-voimasta nollaan alkurullauslaitteella. Kummatkin voimat voidaan muuttaa tasaisesti, jolloin niiden yhteisvaikutusta ajan funktiona esittävä summaviivakuorman kuvaaja on myös suora.
- Kun käytön kuorman vaihto on tehty, alkurullauskäytön kytkin aukeaa automaattisesti ja käyttö pysähtyy. Alkurullauslaitteen 9 lukitusleuat 3 avataan ja se ohjataan ylös vaihdon alkuasentoon. Alkurullauslaite 9 on tällöin valmis ottamaan vastaan uuden rullausakselin rullausakselivastosta seuraavaa vaihtoa varten.
- Rullaimen toimintaa ohjataan ohjausjärjestelmällä, joka perustuu sinänsä tunnettuun ohjelmoitavaan ohjauslogiikkaan tai muuhun vastaavaan ohjausjärjestelmään, jolla em. säädöt voidaan toteuttaa. Rullausvaunujen 6 liikettä voidaan ohjata tarkasti paikkasäädöllä, jolloin ne ja niissä olevat ohjainleuat 8 ovat tarkasti asemoituja rullausakseliin 1 nähden ennen niiden kosketusta rullausakseliin ja kuormituksen nostoa.

On selvää, että keksintö ei rajoitu edellä esitettyyn esimerkkiin, vaan voi vaihdella patenttivaatimusten puitteissa. Edellä esitetyssä rullaintyyppisessä on rullaimen rungon molemmilla sivuilla rullausvaunu 6, joka liikkuu lineaarisesti ja on kuormitusvoimaa välittävässä yhteydessä rullausakselin 1 vastaavaan päätyyn. Sekä rullaussylinteriä 4 että rullausakselia 1 pyöritetään rullauksen aikana, eli kysymyksessä on keskiökäyttöavusteinen rullain. Rullaintyyppi ja/tai rullaimen yksityiskohdat voivat kuitenkin olla erilaiset kuin edellä on mainittu. Rullain voi olla esimerkiksi pintavedolla toimiva, jolloin esimerkiksi vain rullaussylinteri 4 on käytetty. Yhteistä kaikille rullaimille, joissa keksintöä voidaan soveltaa, on se, että siinä on kuormituslaite, joka ajetaan kosketuksiin rullausakselin kanssa siinä vaiheessa, kun rullausakselin ympärille on jo rullautunut paperirainaa alkurullauksessa. Vaihdon hetki voidaan valita myös niin, että pääosa rullauksesta tehdään alkurullauslaitteella ja vasta hieman ennen rullanvaihtoa vaihdetaan rulla kuormituslaitteille. Alkurullauslaite tuleekin tässä yhteydessä käsittää sellaiseksi laitteeksi, jossa voidaan rullata rainaa rullausakselin ympärille ja jonka aiheuttama kuormitus voidaan vaihtaa toisen kuormituslaitteen aiheuttamaan kuormitukseen loppurullauksen ajaksi. Rullain voi olla varustettu esim. kahdella parilla rullausvaunuja.

Rullaussylinterin 4 tilalla voi olla mikä tahansa pintavetolaitteisto, joka muodostaa rullan kanssa nipin, jossa vaikuttaa em. viivakuorma. Pintavetolaitteisto voi olla esim. hihnatelasto.

Patenttivaatimukset:

1. Menetelmä viivakuorman vaihtamiseksi rullaimella, joka käsittää  
5 alkurullauslaitteen (9), rullausakselin (1), pintavetolaitteiston tai vastaava-  
van, ja kuormituslaitteen (8) alkurullauksen jälkeistä rullausta varten ja  
jossa menetelmässä rullaus tapahtuu seuraavasti:
- rullaus aloitetaan ns. alkurullauksena alkurullauslaitteessa  
10 (9), josta rullausakseli (1) ja sille muodostunut rullan alkuosa  
siirretään kuormituslaitteeseen, jolla rullan alkuosan muo-  
dostamisen jälkeiset vaiheet suoritetaan, siten että  
kuormituslaitteen se osa (8), joka välittää kuormitusta rul-  
lausakseliin (1), saatetaan kosketuksiin rullausakselin (1)  
kanssa,
  - 15 - alkurullauslaitteen (9) ja kuormituslaitteen voimalaitteilla  
aiheutetaan pääasiallisesti rullausakselin (1) ympärille muo-  
dostuvan rullan ja pintavetolaitteiston tai vastaavan välisen  
nipin viivakuorma, jota rullauksen aikana säädetään voima-  
laitteiden avulla siten, että saadaan tiettyjen tekijöiden funk-  
20 tion haluttu viivakuorma,
- tunnettu** siitä, että kuormitusta rullausakseliin välittävän osan (8) kos-  
ketus rullausakseliin (1) tapahtuu kuormituslaitteen ollessa oleellisesti  
kuormitusvoimattomassa tilassa.
- 25 2. Patenttivaatimuksen 1 mukainen menetelmä, **tunnettu** siitä, että  
kuormitusta rullausakseliin välittävän osan (8) liike kohti rullausakselia  
(1) pysäytetään ennen kuin mainittu osa (8) saa kosketuksen alku-  
rullauslaitteessa (9) olevaan rullausakseliin (1) ja rullausakselin (1)  
annetaan siirtyä kiinni mainittuun osaan kasvattamalla rullausakselin  
30 ympärille syntyvän rullan halkaisijaa rullaamalla rullausakselille (1) jat-  
kuvatoimisesti rainaa.
- 35 3. Patenttivaatimuksen 2 mukainen menetelmä, **tunnettu** siitä, että  
rullausakselin (1) kuormituksen siirto alkurullauslaitteelta (9) kuormitus-  
laitteelle aloitetaan, kun rullausakselin (1) ympärille muodostuvan rullan  
halkaisijan on annettu kasvaa niin suureksi, että se alkaa liikuttaa tai  
siirtää kuormituslaitetta.

4. Patenttivaatimuksen 1 mukainen menetelmä, **tunnettu** siitä, että kuormitusta rullausakseliin välittävä osa (8) siirretään lähelle rullausakselia (1), minkä jälkeen osa (8) siirretään kuormituslaitteen kuormitustoimilaitteen (11) liikkeestä kineettisesti riippumattomasti kosketuksiin rullausakselin (2) kanssa samalla kun kuormituslaite on ainakin kosketushetkellä kuormitusvoimattomassa tilassa.
5. Jonkin edellisen patenttivaatimuksen mukainen menetelmä, **tunnettu** siitä, että siinä vaiheessa, kun rullausakselin (1) kuormitusta siirretään alkurullauslaitteelta (9) kuormituslaitteelle, tietyn ajan kuluessa alkurullauslaitteen (9) kuormitus pienennetään tietyistä alkuarvosta lähes nolnaan tai nolaksi samalla, kun kuormituslaitteen kuormitusta nostetaan nolasta tiettyyn loppuarvoon.
6. Patenttivaatimuksen 5 mukainen menetelmä, **tunnettu** siitä, että kuormituslaitteen kuormitusta nostetaan tasaisesti ja alkurullauslaitteen (9) kuormitusta lasketaan tasaisesti siten, että niiden yhteisvaikutusta ajan funktiona kuvaava summaviivakuormakäyrä on suora.
7. Jonkin edellisen patenttivaatimuksen mukainen menetelmä, **tunnettu** siitä, että alkurullauksen aikana rullausakselia (1) pidetään alkurullauslaitteen (9) lukitusleuoissa (3), ja kuormituksen siirron aikana rullausakselia (1) aletaan kuormittaa kuormitustoimilaitteilla (11) liikuttavien rullausvaunujen (6) tai vastaavien kääntyvillä ohjainleuoilla (8).

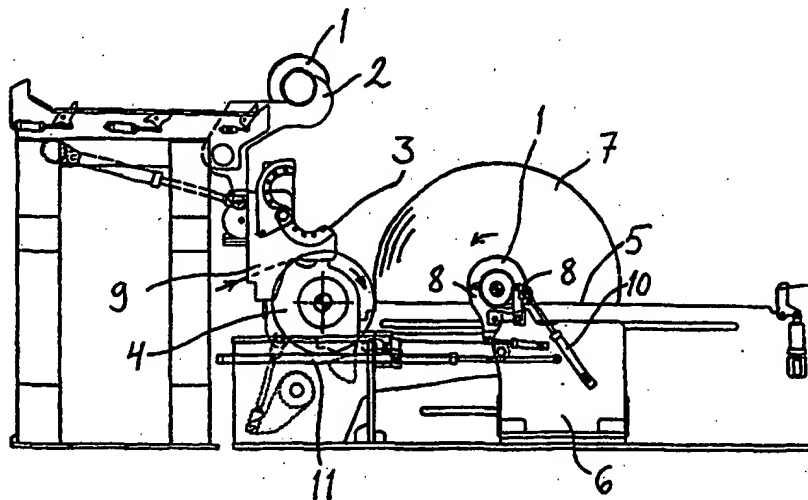
(57) Tiivistelmä

Menetelmässä viivakuorman vaihtamiseksi rullaimella, joka käsittää alkurullauslaitteen (9), rullausakselin (1), pintavetolaitteiston tai vastaavan, ja kuormituslaitteen (8) alkurullauksen jälkeistä rullausta varten, rullaus aloitetaan ns. alkurullauksena alkurullauslaitteessa (9), josta rullausakseli (1) ja sille muodostunut rullan alkuosa siirretään kuormituslaitteeseen, jolla rullan alkuosan muodostamisen jälkeiset vaiheet suoritetaan, siten että kuormituslaitteen se osa (8), joka välittää kuormitusta rullausakseliin (1), saatetaan kosketuksiin rullausakselin (1) kanssa. Alkurullauslaitteen (9) ja kuormituslaitteen voimalaitteilla aiheutetaan pääasiallisesti rullausakselin (1) ympärille muodostuvan rullan ja pintavetolaitteiston tai vastaavan välisen nipin viivakuorma, jota rullauksen aikana säädetään voimalaitteiden avulla siten, että saadaan tiettyjen tekijöiden funktiona haluttu viivakuorma. Kuormitusta rullausakseliin välittävän osan (8) kosketus rullausakseliin (1) tapahtuu kuormitus-laitteen ollessa oleellisesti kuormitusvoimattomassa tilassa.

Fig. 3

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<b>(21) International Application Number:</b> PCT/FI00/00019 <b>(22) International Filing Date:</b> 12 January 2000 (12.01.00) <b>(30) Priority Data:</b> 990044 12 January 1999 (12.01.99) FI <b>(71) Applicant (for all designated States except US):</b> VALMET CORPORATION [FI/FI]; Fabianinkatu 9 A, FIN-00130 Helsinki (FI). <b>(72) Inventors; and</b> <b>(75) Inventors/Applicants (for US only):</b> HEINONEN, Mikko [FI/FI]; Salmelantie 80, FIN-04660 Numminen (FI). RÄTY, Jarkko [FI/FI]; Invantie 18 B 23, FIN-04400 Järvenpää (FI). <b>(74) Agent:</b> TAMPEREEN PATENTTITOIMISTO OY; Hermi- ankatu 6, FIN-33720 Tampere (FI).		<b>(81) Designated States:</b> AE, AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), DM, EE, EE (Utility model), ES, FI, FI (Utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i> <i>In English translation (filed in Finnish).</i>

**(54) Title:** METHOD FOR CHANGING LINEAR LOAD ON A REEL-UP**(57) Abstract**

In the method for changing linear load on a reel-up which comprises an initial reeling device (9), a reeling shaft (1), a surface drive apparatus or the like, and a loading device (8) for the reeling process taking place after initial reeling, the reeling begins as a so-called initial reeling in the initial reeling device (9) from which the reeling shaft (1) and the initial portion of the reel formed thereon is transferred to the loading device by means of which the stages following the formation of the initial portion of the reel are conducted, in such a manner that the part (8) of the loading device which transmits load to the reeling shaft (1) is brought in contact with the reeling shaft (1). The force devices of the initial reeling device (9) and the loading device are primarily utilized to effect the linear load in the nip between the reel formed around the reeling shaft (1) and the surface drive apparatus or the like, the linear load being adjusted during the reeling by means of force devices in such a manner that the desired linear load is attained as a function of given factors. The contact of the part (8) that transmits load to the reeling shaft takes place when the loading device is substantially in a state devoid of loading force.

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## Method for changing linear load on a reel-up

The present invention relates to a method for changing the linear load on a reel-up of a paper web. The reel-up primarily comprises an initial reeling device, a reeling shaft, a reeling cylinder and a loading device. The concept of linear load refers to the force required in the reeling, which loads the paper reel formed on the reeling shaft. Said force required in the reeling is applied to the reel formed on the reeling shaft primarily via the reeling cylinder in such a way that the necessary force, linear load, is generated via the nip between the outer perimeter of said reeling cylinder and the outer perimeter of the reel that is being formed, when the loading of said nip is at least primarily generated by means of force devices acting on the ends of the reeling shaft. In the initial reeling device the formation of the bottom portion of the reel on the reeling shaft takes place, whereafter the reeling shaft is transferred to the loading device to be reeled to form a full paper reel.

The force loading the nip can be adjusted by means of control signals derived on the basis of the position of the initial reeling device and the loading device in such a way that the loading of the nip is dependent in a predetermined manner on a possible initial reeling angle, the diameter of the growing reel, or time, i.e. the linear load changes as a function of a measurable factor. At the transfer stage, in which the reeling shaft and the reel to be formed thereon are transferred from the support and loading applied by said initial reeling device or the like to the loading effected by the loading device, a force peak which disturbs the reeling process is often generated in the linear load.

Said reel-up is generally used for example for reeling up of a paper web passed for example from a paper machine or a finishing device for paper. The reel-up in question is a continuous reel-up in which machine reels are reeled successively. When the reel has become full, the web is changed to travel to a new reeling shaft. The web is reeled around the reeling shaft and in the reel-up the reel which is gradually growing into its full size, is pressed against the reeling cylinder by means of a loading device, the web travelling over the reeling cylinder in a particular sector and the reeling cylinder being rotated at a



peripheral speed corresponding to the desired speed of the web. Before the reel is completed, a new reeling shaft can, when accelerated to the running speed, be brought in nip contact with the reeling cylinder by means of the initial reeling device in such a way that it also attains the corresponding peripheral speed. As soon as the paper reel has attained the desired diameter, it is transferred away from the reeling cylinder. Thus, its peripheral speed starts to become lower, which results in that a web loop is formed between the new reel shaft and the complete reel. This loop is guided e.g. by means of a pressurized air jet to wind around a new reel shaft, and it is torn off from the finished reel as a result. There are also other known ways of change.

Because of the variations in the loading, it is a problem in the aforementioned transfer stage especially when reeling takes place at high speeds, that wrinkles are produced in the inner layers of the reels in such a manner that the bottom portion of the reels is rejected as a broke. The amount of paper discharged as broke may be as high as 2 to 3 %, which causes considerable financial losses for the paper mill.

A known method for changing the linear load on the reel-up is disclosed for example in the patent FI-71107, and in the corresponding US patent 4634068. Here, secondary forks are driven against the reeling shaft which is initially reeled in primary forks, in such a manner that the forks hit the reeling shaft. The linear load is controlled in this transfer stage by evenly reducing the loading produced by the primary forks, and by evenly increasing the loading of the secondary forks at the same time, wherein the sum linear load remains substantially equal. The impact on the reeling shaft, however, always results in a clear linear load peak. Thus, in addition to the change of the loading, the disturbance is also caused by the transfer of the loading device to a position where it can receive the reel from the initial reeling device, and the latter factor can act in the transfer of the loading, even though the linear load could be controlled well by controlling the actuators affecting the loading at the transfer stage.

For example in the generally used reel-up type, there are reeling carriages which can be moved in the longitudinal direction of the machine (machine direction), which reeling carriages function as a loading device when the reel is completed after the initial reeling. The carriages are provided with guide jaws, which press the ends of the reeling shaft towards the reeling cylinder. The guide jaws press the reeling shaft with a force, which is determined according to the force of the actuators used for moving the reeling carriages. When the actuators are used to drive the carriage against the reeling shaft, a certain pressure always prevails therein to ensure the movement, the pressure causing a "load stroke" when the guide jaws touch the reeling shaft.

By means of the method according to the invention, it is possible to avoid additional loading exerted on the reeling shaft at that stage when the reeling shaft is transferred from the initial reeling device to the loading of that loading device by means of which most of the reel is formed. The method according to the invention is primarily characterized in what will be presented in the characterizing part of the appended claim 1.

By means of the method according to the invention, the variation of the loading occurring in the change of the reeling shaft can be minimized even further, and thus the paper reels are formed in such a manner that they are of uniform quality for example in view of further processing procedures. The invention is based on the adjustment of the positions or location of the guide jaws as well as on the adjustment of the force of the loading device before the transfer stage in such a manner that no loading peak is generated.

In the following, the method according to the invention will be described by means of an example with reference to the appended drawings, in which

Fig. 1 shows a side-view of a reel-up type as an example,

Fig. 2 shows loading pressures of prior art at the transfer stage,

Fig. 3 shows schematically the first embodiment of the method, and

Fig. 4 shows schematically a second embodiment of the method.

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10 In this case the method according to the invention is implemented by means of a reel-up according to Fig. 1, in which locking jaws 3 of the initial reeling device 9 correspond to the primary forks of the aforementioned patent FI-71107 and secondary jaws 8 journaled  
15 pivotable in the vertical plane in reeling carriages 6 correspond to the secondary forks of the patent, the jaw on the side of the reeling cylinder 4 being a locking jaw and the jaw on the other side of the end of the reeling shaft being a guide jaw. The reeling carriages 6 move along  
20 guide rails by means of linear bearings and hydraulic cylinders 11 which produce the loading of the reel, and of which the term "loading actuator" will be used hereinbelow. The loading device by means of which the reel is loaded against the reeling cylinder 4, is composed of hydraulic cylinders 11 and a mechanism by means of which the  
25 hydraulic cylinders are in a power transmitting connection with the ends of the reeling shaft, more precisely with the bearing housings of the reeling shaft. The mechanism, by means of which the force of the hydraulic cylinders is transmitted to the ends of the reeling shaft, is in this case composed of the reeling carriages 6 and the guide jaws 8. For the purpose of measuring the diameter of the reel, the reeling  
30 carriages 6 are provided with devices for measuring the position, which are placed on both sides of the machine. In the reel-up, the reel is supported in a known manner by the ends of the reeling shaft by means of reeling rails 5 or corresponding supporting elements.

35 According to Fig. 1, in the beginning of the change of the reeling shaft, the initial reeling device 9 is in the upper position and the locking jaws 3 of the initial reeling device are open. The clutch of the initial reeling drive is also open. In the reeling shaft storage there is an empty reeling shaft to be picked up by lowering arms 2.

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The reeling shaft 1 is lowered to the initial reeling device 9 by means of lowering arms 2. The jaws 3 of the initial reeling device are

automatically locked as soon as the reeling shaft 1 is positioned down in the jaws 3 of the initial reeling device 9. The clutch of the initial reeling drive is closed and it is shifted to crawling mode. The empty reeling shaft 1 is accelerated to the web speed and the initial reeling device 9 is turned a given distance, for example into a certain angular position with respect to the reeling cylinder 4, or in such a manner that the reeling shaft 1 is lowered on the rails. The nip between the reeling cylinder 4 and the reeling shaft 1 is automatically closed at some point during the turning movement. The reeling carriages 6 are transferred to a change position when the paper reel has reached the desired diameter. The reel is thus transferred away from the reeling cylinder 4. The web is changed on a new reeling shaft 1 by a suitable manner.

The act of stopping the full reel 7 takes place by braking. When the reel 7 has stopped, the braking ceases. The guide jaws 8 and the locking jaws 8 of the reeling carriages 6 turn downward automatically, whereafter the full reeling shaft 1 rolls along the rails 5 to a stopper, wherefrom it can be transferred away from the machine by means of a crane.

During the process of moving the full reel 7 away from the machine, the web is reeled on the reeling shaft 1 located in the initial reeling device 9, and the reel is loaded against the reeling cylinder 4 by means of the actuators of the initial reeling device 9, which act upon the ends of the reeling shaft via the locking jaws 3. At the next stage the initial reeling device 9 is turned down on the rails 5 if the change has been conducted in the upper angular position of the reeling shaft, and the reeling carriages 6 are guided towards the reeling shaft 1 located on top of the rails 5 in the initial reeling device 9.

Fig. 2 illustrates the pressure levels of the actuators responsible for the loading of the initial reeling device 9 and the pressure levels of the loading actuators 11 responsible for the loading of the reeling carriages at a transfer stage. The guide jaws 8 have been turned up by means of actuators 10 located in the reeling carriages 6, wherein the guide jaw causes a pressure peak marked with the letter P when it hits the reeling cylinder, and a corresponding loading peak in the reel-up.

In the invention the contact of the loading device with the reeling shaft takes place without loading force, in other words the loading actuators 11 are devoid of the force effecting the linear load.

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According to the first embodiment of the invention (Fig. 3), the carriages 6 are guided towards the reeling shaft 1 at a very low speed, the guide jaws 8 being positioned in the upper position, and the carriages 6 are stopped approximately 10 mm before the guide jaws 8 enter in contact with the reeling shaft 1 in the initial reeling device 9. At this stage, when the guide jaws 8 are not yet in contact with the reeling shaft 2, pressure is switched off from the loading actuators 11, and their chambers are open to the tank lines via valves. The next step is to wait until the diameter of the web reel R grows to such a dimension that the end of the reeling shaft 1 is transferred against the guide jaw 8 and starts to move the reeling carriages 6 along itself. This can be detected from the position information of the reeling carriages 6, for example by means of a sensor indicating the position. Thus, the locking jaws 8 of the reeling carriages 6 can be lifted up on the opposite side of the ends of the reeling shaft 1, wherein they lock the reeling shaft 1 to the reeling carriages 6 when they are closed. At the same time the pressure can be switched to the loading actuators. The change of the linear load takes place for example according to principle described in the publication FI-71107 and shown in Fig. 2, in such a manner that the loading effected by the initial reeling device 9 is reduced from a given starting level to the zero level at the same time when the loading caused by the reeling carriages is increased, until the loading equals the loading of the initial reeling device 9 before starting the change, in other words the overall loading remains constant. The principle is thus the same as the one in Fig. 2, but the act of increasing the loading of the loading device and thereby the act of increasing the linear load begins from zero. A linear load peak is not generated because the guide jaws 8 are not driven against the reeling shaft, but the web reel can grow into engagement with the reeling carriages 6 freely.

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According to a second alternative (Fig. 4), the reeling carriages are driven to a load transfer position when both the guide jaws and the locking jaws are in the lower position. The guiding carriages are transferred to the correct position by position control in such a manner that the jaws are closed on both sides of the ends of the reel spool 1. When the jaws 8 are closed, the force of the loading actuators 11 is set to 0 N, wherein the contact to the reeling shaft 1 takes place without loading force, and a loading peak does not occur. In practice the reeling carriages 6 are set to force control mode and the force target is set to 0 N. Thereafter the loading is increased in a similar manner as described above.

In both alternatives the loading forces can be ramped clearly from zero to the linear load force by means of the loading device and from the linear load force to zero by means of the initial reeling device. Both forces can be changed evenly, wherein the graph of the sum linear load illustrating their overall effect as a function of the time is also linear.

When the load of the drive has been changed, the clutch of the initial reeling drive opens automatically and the drive is stopped. The locking jaws 3 of the initial reeling device 9 are opened and it is guided upwards into the initial position of the change sequence. Then the initial reeling device 9 is ready to receive a new reeling shaft from a storage of reeling shafts for the next change.

The function of the reel-up is controlled with a control system, which is based on programmable control logic known as such or on a corresponding control system, by means of which the aforementioned adjustments can be implemented. The motion of the reeling carriages 6 can be controlled in a precise manner by means of position control, wherein said reeling carriages and the guide jaws 8 therein will be positioned accurately with respect to the reeling shaft 1 before they enter in contact with the reeling shaft and before the load is increased.

It is obvious that the invention is not restricted to the above-described example, but it can vary within the scope of the claims. In the above-

described reel-up type there is a reeling carriage 6 on both sides of the frame of the reel-up, which reeling carriage moves in a linear manner and is in a power transmitting connection with the corresponding end of the reeling shaft 1. Both the reeling cylinder 4 and the reeling shaft 1 are rotated during the reeling, i.e. the reel-up in question is a centre-drive assisted reel-up. The reel-up type and/or the details of the reel-up can, however, differ from those mentioned above. The reel-up can for example function by surface drive, wherein for example only the reeling cylinder 4 is driven. It is common to all reel-ups in which the invention can be applied that they are provided with a loading device which is driven into contact with a reeling shaft at that stage when the paper web has already been reeled around the reeling shaft in the initial reeling. The moment of the change can also be selected in such a manner that most of the reeling process is conducted by means of the initial reeling device and only a short time before the reel change the reel is changed to the loading devices. Thus, in this context, the initial reeling device has to be regarded as a device in which it is possible to reel the web around the reeling shaft and which causes a load which can be changed to a load effected by another loading device for the duration of the final reeling. The reel-up can be provided e.g. with two pairs of reeling carriages.

The reeling cylinder 4 can be replaced with any surface drive apparatus, which forms a nip with the reel, in which nip the aforementioned linear load is effective. The surface drive apparatus can be for example a belt and roll assembly.

Claims:

1. Method for changing linear load on a reel-up which comprises an initial reeling device (9), a reeling shaft (1), a surface drive apparatus or the like, and a loading device (8) for the reeling process taking place after initial reeling, in which method the reeling takes place in the following way:

— the reeling begins as a so-called initial reeling in the initial reeling device (9) from which the reeling shaft (1) and the initial portion of the reel formed thereon is transferred to the loading device by means of which the stages following the formation of the initial portion of the reel are conducted, in such a manner that the part (8) of the loading device which transmits load to the reeling shaft (1) is brought in contact with the reeling shaft (1),

— the force devices of the initial reeling device (9) and the loading device are primarily utilized to effect the linear load in the nip between the reel formed around the reeling shaft (1) and the surface drive apparatus or the like, the linear load being adjusted during the reeling by means of force devices in such a manner that the desired linear load is attained as a function of given factors,

**characterized** in that the contact of the part (8) that transmits load to the reeling shaft (1) takes place when the loading device is substantially in a state devoid of loading force.

2. Method according to claim 1, **characterized** in that the movement of the part (8) that transmits load to the reeling shaft towards the reeling shaft (1) is stopped before said part (8) enters in contact with the reeling shaft (1) located in the initial reeling device (9) and the reeling shaft (1) is allowed to move in contact with said part by increasing the diameter of the reel produced around the reeling shaft by continuously reeling the web on the reeling shaft (1).

3. Method according to claim 2, **characterized** in that the transfer of the load applied to the reeling shaft (1) from the initial reeling device (9) to the loading device is started when the diameter of the reel formed



around the reeling shaft (1) has been allowed to grow so large that it starts to move or transfer the loading device.

5 4. Method according to claim 1, **characterized** in that the part (8) that transmits load to the reeling shaft is transferred close to the reeling shaft (1), whereafter the part (8) is transferred into contact with the reeling shaft (2) kinetically independently of the motion of the loading actuator (11) while the loading device is at least in the moment of contact in a state devoid of loading force.

10 5. Method according to any of the foregoing claims, **characterized** in that at that stage when the load applied to the reeling shaft (1) is transferred from the initial reeling device (9) to the loading device, within a given time the loading caused by the initial reeling device (9) is  
15 reduced from a given initial value nearly down to zero or to zero at the same time when the loading of the loading device is increased from zero to a given final value.

20 6. Method according to claim 5, **characterized** in that the loading of the loading device is increased evenly and the loading of the initial reeling device (9) is reduced evenly in such a manner that the sum linear load graph illustrating their overall effect as a function of time is linear.

25 7. Method according to any of the foregoing claims, **characterized** in that during the initial reeling the reeling shaft (1) is kept in the locking jaws (3) of the initial reeling device (9), and during the transfer of the load the pivotable guide jaws (8) of the reeling carriages (6) or the like movable by means of the loading actuators (11) start to load the reeling shaft (1).

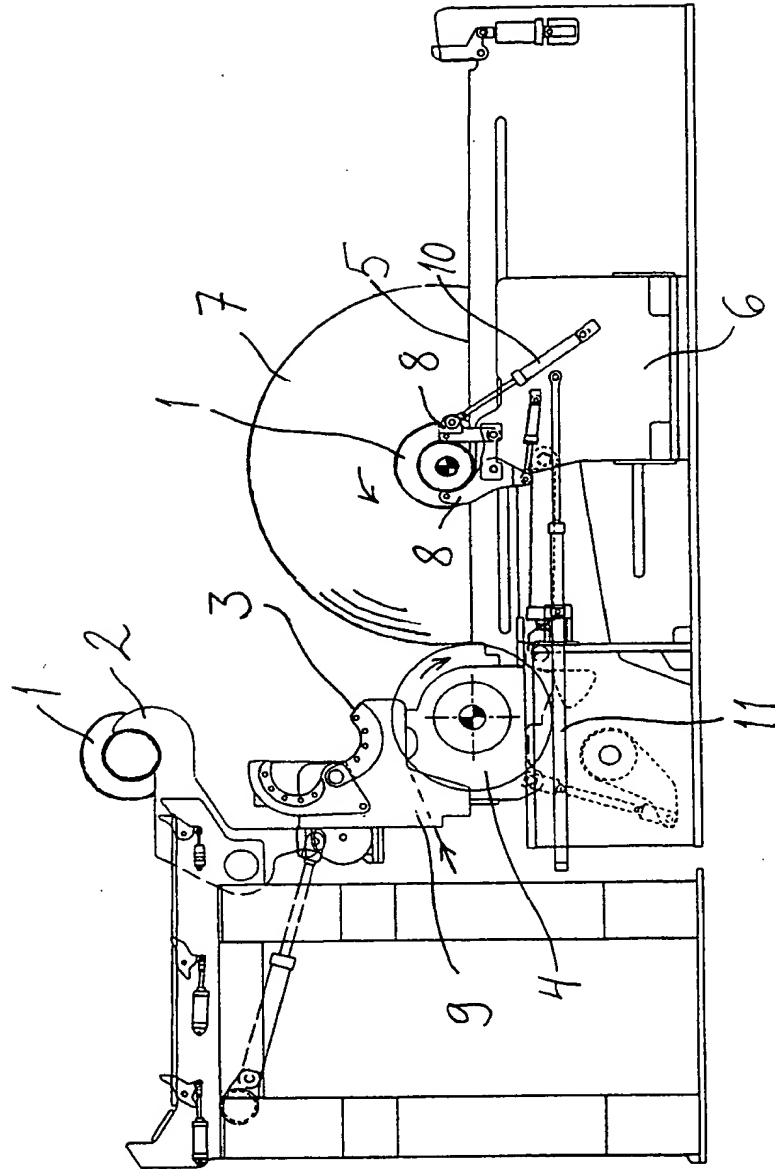


Fig. 1

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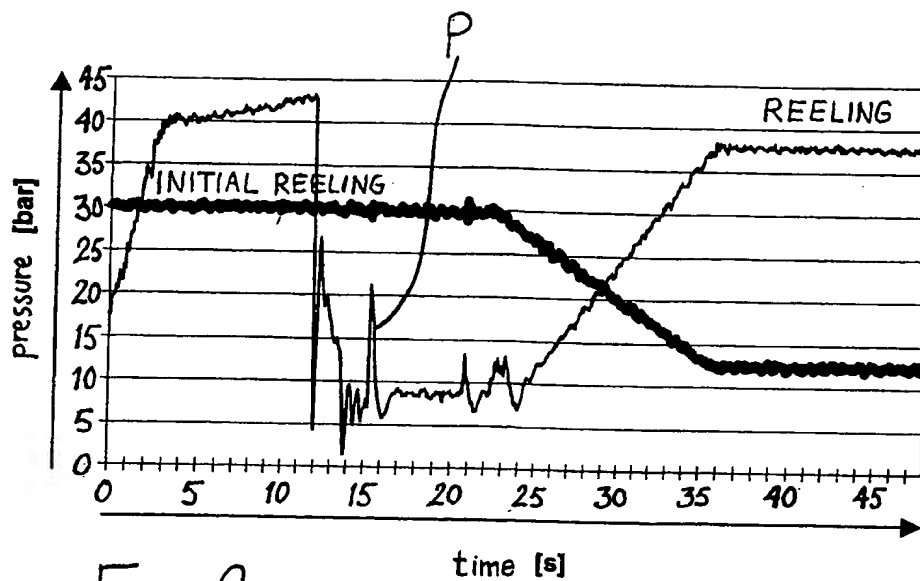


Fig. 2

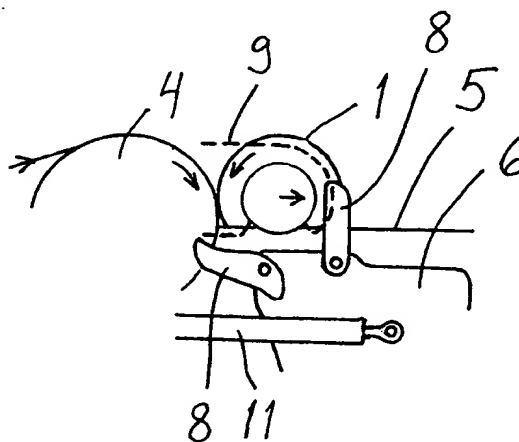


Fig. 3

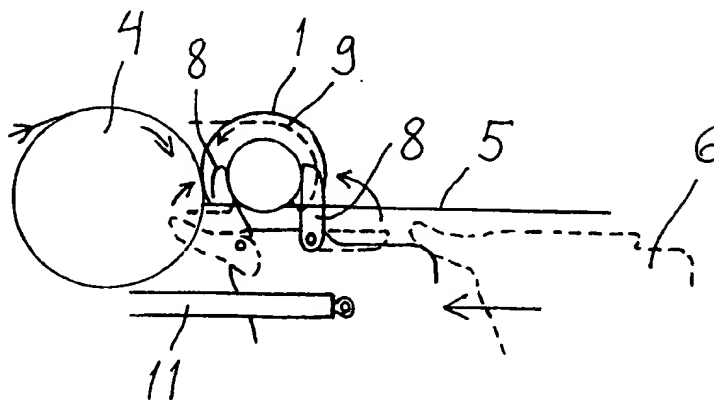


Fig. 4

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00019

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B65H 19/22, B65H 18/26

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B65H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5184787 A (D. HOLZINGER ET AL), 9 February 1993 (09.02.93), column 4, line 40 - column 5, line 23, figures --	1
X	US 3202374 A (R.W. PHELPS), 24 August 1965 (24.08.65), column 2, line 57 - column 3, line 55, figure 1 --	1
X	WO 9424033 A1 (THE BLACK CLAWSON COMPANY), 27 October 1994 (27.10.94), abstract, figures --	1
A	DE 19735590 A1 (VOITH SULZER PAPIERMASCHINEN GESELLSCHAFT MBH), 19 November 1998 (19.11.98) --	

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

3 May 2000

Name and mailing address of the ISA

Swedish Patent Office

Box 5055 S-102 42 STOCKHOLM

Date of mailing of the international search report

10-05-2000

Authorized officer

Christer Falk / MR

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00019

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Information on patent family members

International application No.

PCT/FI 00/00019

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